

August 1993

ISSN 0009-2614

CHEMICAL PHYSICS LETTERS

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**MASTER INDEX VOLUMES 201-210
JANUARY 1993-JULY 1993**

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Printed in The Netherlands

Published weekly

Library of Congress Catalog Card Number 68-26532

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Electron Paramagnetic Resonance of d Transition Metal Compounds

by F.E. Mabbs and D. Collison, University of Manchester, Manchester, UK

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Electron paramagnetic resonance (epr) spectroscopy is a sensitive and versatile method of studying paramagnets, which is finding increasing use in chemistry, biochemistry, earth and materials sciences.

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Progress in Research and Development of Processes and Products from Sols and Gels

Proceedings of the 2nd European Conference on Sol-Gel Technology,
Saarbrücken, Germany, 2-5 June 1991

edited by S. Vilminot, R. Nass and H. Schmidt

European Materials Research Society Monographs Volume 5

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Volume 6: Coadsorption, Promoters and Poisons

Although there has been a tremendous development of new techniques to facilitate the study of well-characterised surfaces, there remains a dearth of publications devoted to the application of these methods. This is particularly true in the case of multi-technique studies, directed to understanding key aspects of surface chemistry and physics. This series of books sets out to rectify this state of affairs by providing reviews which concentrate on the scientific achievements in terms of new understanding of the chemical physics of surfaces, rather than the methodology. Since the earlier volumes have appeared, there has been an increasing shift of emphasis to these multi-faceted approaches to understanding surface chemical problems, which makes the series even more appropriate to the needs of the research community.

The present volume provides particularly clear evidence of this growth. In the specific area of application of heterogeneous catalysis, substantial progress is being made in confronting problems of increasing complexity, such as those associated with *Coadsorption, Promoters and Poisons*, which forms the subject matter of this book. This progress is reflected in sophisticated theoretical calculations as well as experiments, and both areas are covered in chapters which are written by acknowledged experts in the field. Specific problems covered include the effect of

promoters (especially alkali metals) and poisons in CO, water and hydrogen surface chemistry including Fischer-Tropsch and water-gas shift reactions, and in ammonia synthesis. In addition, two chapters are devoted to different aspects of alloy surface chemistry (bulk alloys and thin overlayer films), while one further synergistic effect concerns the so-called strong metal support interaction. In all cases, connections are made to the related catalyst studies, although the emphasis is on the achievements of the model investigations of well-characterised surfaces.

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Printed on acid-free paper.



April 1994

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PHYSICS
LETTERS**

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List of advisory editors

Professor S. Andersson, Department of Physics, Chalmers University of Technology, S-412 96 Goteborg, Sweden.
FAX 46-31-7723134

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FAX 39-75-5855606

Professor A.J. Bard, Hackerman/Welch Regents Chair in Chemistry, Department of Chemistry, The University of Texas at Austin, Austin, TX 78712-1167, USA. FAX 1-512-4710088

Dr. G.S. Beddard, Department of Chemistry, The University, Manchester M13 9PL, UK. FAX 44-61-2754598

Professor Dr. V.E. Bondybey, Institut für Physikalische und Theoretische Chemie der Technischen Universität München, Lichtenbergstrasse 4, D-85748 Garching near Munich, Germany. FAX 49-89-32092727

Dr. C. Bréchnac, Laboratoire Aimé Cotton, Bâtiment 505, Campus d'Orsay, 91405 Orsay Cedex, France.
FAX 33-1-69076891

Dr. L.E. Brus, AT&T Bell Laboratories, 600 Mountain Avenue, P.O. Box 636, Murray Hill, NJ 07974-0636, USA. FAX 1-908-5823958

Professor A.L. Buchachenko, N.N. Semenov Institute of Chemical Physics, Russian Academy of Sciences, Ulitsa Kosygina 4, 117334 Moscow, Russian Federation. FAX 7-095-9382156

Professor L.S. Cederbaum, Theoretische Chemie, Institut für Physikalische Chemie, Universität Heidelberg, Im Neuenheimer Feld 253, D-69120 Heidelberg, Germany. FAX 49-6221-563199

Dr. Y. Chabal, AT&T Bell Laboratories, Room 1C-462, Murray Hill, NJ 07974-2070, USA. FAX 1-908-5823901

Professor D. Chandler, Department of Chemistry, University of California, Berkeley, CA 94720, USA. FAX 1-510-6428369

Dr. D.C. Clary, Department of Chemistry, University of Cambridge, Cambridge CB2 1EW, UK. FAX 44-223-336362

Professor E. Clementi, CRS4, P.O. Box 488, 09100 Cagliari, Italy. FAX 39-70-2796400

Professor F.F. Crim, Department of Chemistry, University of Wisconsin at Madison, 1101 University Avenue, Madison, WI 53706, USA. FAX 1-608-2629918

Professor A. Dalgarno, F.R.S., Harvard College Observatory and Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge, MA 02138, USA. FAX 1-617-4955970

Dr. P.M. Dehmer, Argonne National Laboratory, Building 203-B161, Argonne, IL 60439, USA. FAX 1-708-2527415

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- Dr. R.H. Friend, F.R.S., Cavendish Laboratory, University of Cambridge, Madingley Road, Cambridge CB3 0HE, UK. FAX 44-223-63263
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- Professor R.M. Hochstrasser, Department of Chemistry/D5, University of Pennsylvania, Philadelphia, PA 19104, USA. FAX 1-215-8980590

- Professor Dr. G.L. Hofacker, Lehrstuhl für Theoretische Chemie, Technische Universität München, Lichtenbergstrasse 4, W-8046 Garching near Munich, Germany. FAX 49-89-32093622
- Professor Dr. A.J. Hoff, Department of Biophysics, Huygens Laboratorium, Rijksuniversiteit te Leiden, Postbus 9504, 2300 RA Leiden, The Netherlands. FAX 31-71-275819
- Professor M. Ito, Institute for Molecular Science, Myodaiji, Okazaki 444, Japan. FAX 81-564-542254
- Professor C.K. Jørgensen, Département de Chimie Minérale, Analytique et Appliquée, 30 Quai Ansermet, CH-1211 Geneva 4, Switzerland
- Professor J. Jortner, Institute of Chemistry, Tel-Aviv University, 61390 Ramat Aviv, Tel Aviv, Israel. FAX 972-3-6415054
- Professor J.L. Kinsey, Dean and D.R. Bullard-Welch Foundation Professor of Science, Wiess School of Natural Sciences, Rice University, P.O. Box 1892, Houston, TX 77251, USA. FAX 1-713-2855401
- Professor A.W. Kleyn, FOM-Instituut voor Atoom- en Molekulfysica, Kruislaan 407, 1098 SJ Amsterdam, The Netherlands. FAX 31-20-6684106
- Professor T. Kobayashi, Department of Physics, Faculty of Science, University of Tokyo, 7-3-1 Hongo, Bunkyo ku, Tokyo 113, Japan. FAX 81-3-38187812
- Professor Dr. D.M. Kolb, Abt. Elektrochemie, Universität Ulm, D-89069 Ulm, Germany. FAX 49-731-5022769
- Professor K. Kuchitsu, Department of Chemistry, Josai University, Keyakidai, Sakado 350-02, Japan. FAX 81-492-717985
- Professor Y.T. Lee, Lawrence Berkeley Laboratory, University of California, 1 Cyclotron Road, Berkeley, CA 94720, USA. FAX 1-510-4865311
- Professor A.C. Legon, Department of Chemistry, University of Exeter, Stocker Road, Exeter EX4 4QD, UK. FAX 44-392-263434
- Professor S.R. Leone, Division of Chemistry, Joint Institute for Laboratory Astrophysics, Campus Box 440, University of Colorado, Boulder, CO 80309, USA. FAX 1-303-4925235
- Professor V.S. Letokhov, Institute of Spectroscopy, Russian Academy of Sciences, 142092 Troitzk, Moscow Region, Russian Federation
- Professor R.D. Levine, Department of Physical Chemistry, The Hebrew University of Jerusalem, Jerusalem 91904, Israel. FAX 972-2-513742
- Professor C.M. Lieber, Department of Chemistry, Harvard University, 12 Oxford Street, Cambridge, MA 02138, USA. FAX 1-617-4965442
- Professor W.C. Lineberger, Department of Chemistry and JILA, Box 440, University of Colorado, Boulder, CO 80309, USA. FAX 1-303-4928994
- Dr. R.M. Lynden-Bell, University Chemical Laboratory, Lensfield Road, Cambridge CB2 1EW, UK. FAX 44-223-336362
- Professor Dr. J. Manz, Fachbereich Chemie, Institut für Physikalische und Theoretische Chemie, Freie Universität Berlin, Takustrasse 3, D-14195 Berlin, Germany. FAX 49-30-8384792
- Professor C.A. McDowell, Department of Chemistry, University of British Columbia, 2036 Main Mall, Vancouver 8, British Columbia, Canada V6T 1Y6. FAX 1-604-2282847

Professor B.V. McKoy, Division of Chemistry and Chemical Engineering, The Chemical Laboratories, California Institute of Technology, Pasadena, CA 91125, USA. FAX 1-818-5777715

Dr. K.A. McLauchlan, F.R.S., Physical Chemistry Laboratory, South Parks Road, Oxford OX1 3QZ, UK. FAX 44-865-275410

Professor W.H. Miller, Department of Chemistry, University of California, Berkeley, CA 94720, USA. FAX 1-510-6428369

Professor Yu.N. Molin, Institute of Chemical Kinetics and Combustion, Academy of Sciences, 630090 Novosibirsk, Russian Federation. FAX 7-3832-352350

Professor K. Morokuma, Department of Chemistry, Emory University, Atlanta, GA 30322, USA. FAX 1-404-7276586

Professor S. Mucamel, Department of Chemistry, University of Rochester, Rochester, NY 14627, USA. FAX 1-716-4736889

Professor H. Nakatsuji, Department of Synthetic Chemistry, Faculty of Engineering, Sakyo-Ku, Kyoto 606-01, Japan. FAX 81-75-7535910

Professor J.K. Nørskov, Physics Department, Building 307, Technical University of Denmark, DK-2800 Lyngby, Denmark. FAX 45-45-932399

Professor B.J. Orr, School of Chemistry, Macquarie University, Sydney, NSW 2109, Australia. FAX 61-2-8058313

Professor M. Parrinello, IBM Research Division, Zurich Research Laboratory, CH-8803 Ruschlikon, Switzerland. FAX 41-1-7240809

Professor Dr. S.D. Peyerimhoff, Lehrstuhl für Theoretische Chemie der Universität Bonn, Wegelerstrasse 12, W-5300 Bonn 1, Germany. FAX 49-228-732557

Professor A. Pines, Department of Chemistry, University of California, Berkeley, CA 94720, USA. FAX 1-510-6428369

Professor Dr. M. Quack, Laboratorium für Physikalische Chemie, ETH-Zentrum, CH-8092 Zurich, Switzerland. FAX 41-1-6321021

Professor C.N.R. Rao, F.R.S., Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore 560012, India. FAX 91-80-341683

Dr. A.R. Ravishankara, NOAA, Environmental Laboratories, Mail stop R/E/AL2, 325 Broadway, Boulder, CO 80303-3328, USA. FAX 1-303-4975822

Professor S.A. Rice, Department of Chemistry, The James Franck Institute, The University of Chicago, 5640 Ellis Avenue, Chicago, IL 60637, USA. FAX 1-312-7025863

Professor J.L. Rivail, Laboratoire de Chimie Théorique, Université de Nancy I, B.P. 239, 54506 Vandœuvre lès Nancy Cedex, France. FAX 33-83-912530

Professor P.J. Rossky, Department of Chemistry & Biochemistry, University of Texas at Austin, Austin, TX 78712-1167, USA. FAX 1-512-4711624

Professor R.J. Saykally, Department of Chemistry, University of California, Berkeley, CA 94720, USA. FAX 1-510-6428369

Professor H.F. Schaefer III, Center for Computational Quantum Chemistry, University of Georgia, Athens, GA 30602, USA. FAX 1-404-5420406

- Professor G.C. Schatz, Department of Chemistry, Northwestern University, 2145 Sheridan Road, Evanston, IL 60208, USA. FAX 1-708-4672447
- Dr. R. Schinke, Max-Planck Institut für Strömungsforschung, Postfach 2853, D-37073 Göttingen, Germany. FAX 49-551-7092607
- Professor E.W. Schlag, Lehrstuhl für Physikalische Chemie I, Technische Universität München, Lichtenbergstrasse 4, W-8046 Garching near Munich, Germany. FAX 49-89-32093389
- Professor D.A. Shirley, 207 Old Main, Pennsylvania State University, University Park, PA 16802, USA. FAX 1-814-8639659
- Dr. W. Siebrand, Steacie Institute for Molecular Sciences, National Research Council of Canada, Ottawa, Ontario, Canada K1A 0R6. FAX 1-613-9520974
- Professor P.E.M. Siegbahn, Stockholms Universitet, Fysikum, Vanadisvägen 9, S-11 346 Stockholm, Sweden. FAX 46-8-347817
- Professor J. Simon, Laboratoire de Chimie et Electrochimie des Matériaux Moléculaires, ESPCI, CNRS UA 429, 10 rue Vauquelin, 75231 Paris Cedex 05, France. FAX 33-1-40794425
- Professor J.P. Simons, F.R.S., Physical Chemistry Laboratory, University of Oxford, South Parks Road, Oxford OX1 3QZ, UK. FAX 44-865-275410
- Professor R.E. Smalley, Department of Chemistry, Rice University, Houston, TX 77001, USA. FAX 1-713-2855155
- Professor I.W.M. Smith, Department of Chemistry, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK. FAX 44-21-4144403
- Dr. B. Soep, Laboratoire de Photophysique Moléculaire, Bâtiment 213, Université de Paris Sud, 91405 Orsay, France. FAX 33-1-69416777
- Professor S. Stolte, Department of Chemistry of the Free University, De Boelelaan 1083, 1081 HV Amsterdam, The Netherlands. FAX 31-20-6461479
- Professor W.C. Stwalley, Department of Physics, University of Connecticut, 2152 Hillside Road, U-46, Storrs, CT 06269-3046, USA. FAX 1-203-4863346
- Professor K. Tanaka, The Institute for Solid State Physics, The University of Tokyo, 7-22-1 Roppongi, Minato-ku, Tokyo 106, Japan. FAX 81-3-34015169
- Professor B.A. Thrush, F.R.S., Department of Physical Chemistry, University of Cambridge, Lensfield Road, Cambridge CB2 1EP, UK. FAX 44-223-336362
- Professor J. Troe, Institut für Physikalische Chemie der Universität, Tammannstrasse 6, D-37077 Göttingen, Germany. FAX 49-551-393144
- Professor D.G. Truhlar, Department of Chemistry, University of Minnesota, Minneapolis, MN 55455, USA. FAX 1-612-6269390
- Professor J.J. Valentini, Department of Chemistry, Columbia University, New York, NY 10027, USA. FAX 1-212-9321289
- Professor H. Walther, Max-Planck-Institut für Quantenoptik, Ludwig-Prandtl-Strasse 10, D-85748 Garching, Germany. FAX 49-89-32905710

Professor D.A. Wiersma, Department of Chemistry, Ultrafast Laser and Spectroscopy Laboratory, University of Groningen, Nijenborgh 4, 9747 AG Groningen, The Netherlands. FAX 31-50-634441

Professor C. Wittig, Department of Chemistry, University of Southern California, Los Angeles, CA 90089, USA. FAX 1-213-7402701

Professor Dr. H.C. Wolf, Physikalisches Institut der Universität, Pfaffenwaldring 57, D-70550 Stuttgart 80, Germany. FAX 49-711-6855281

Dr. P.G. Wolynes, University of Illinois, School of Chemical Sciences, 505 South Mathews Avenue, Urbana, IL 61801, USA. FAX 1-217-2448068

Professor K. Yoshihara, Institute for Molecular Science, Okazaki 444, Japan. FAX 81-564-542254

Professor R.N. Zare, Department of Chemistry, Stanford University, Stanford, CA 94305, USA. FAX 1-415-7250259

Professor C.-H. Zhang, National Natural Science Foundation of China, 35 Huayuan Beilu, East Gate, Haidian District, Beijing 100083, People's Republic of China. FAX 86-1-2010306



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Mössbauer Studies of Surface Layers

By G.N. Belozerski

Studies in Physical and Theoretical Chemistry Volume 81

Mössbauer spectroscopy has evolved as one of the few methods available for investigation of solids differing in depth by several orders of magnitude. This recent development has made the problems of surface investigation and the study of separate layers amenable to investigation. The parameters of the hyperfine interaction derived from the Mössbauer spectra provide valuable information on the chemical bond character and on magnetic properties of surface layers as well as on the change of the properties with the depth from the outermost surface layer. It is possible to carry out quantitative phase analysis and to use the technique to study different transformations in the solid which result from external effects under a wide range of temperatures and pressures.

This book is one of the first attempts at a consistent presentation of theoretical and practical problems of the use of Mössbauer spectroscopy to study solid surfaces, its applications, and development. The applications include: surface studies with hyperfine probes in the following fields: oxidation and corrosion of metals and alloys; passivating and protective coatings; physics of metals; annealing and quenching, mechanical and chemical treatment, ion implantation and laser treatment; texture of near-surface layers. Mössbauer spectroscopy is one of the best methods for *in situ* characterization of solid/solid and solid/solution interfaces. It lends itself to *in situ* studies of surfaces under various coatings and processes, surface magnetism and the effect of the gas phase on the properties of the surface layers and the structure and magnetic properties of epitaxially grown monolayers on the surface of oriented single crystals.

Contents: Preface. 1. **Physical Concepts of the Method.** General Aspects of Mössbauer Spectroscopy. Hyperfine Interactions and Line Positions in Mössbauer Spectra. Relative Intensities of Spectral Lines. Experimental. References. 2. **Mössbauer Spectroscopy Based on Detection of Electromagnetic Radiation.** Radiation Transmission through Matter. Low-Energy γ -Quanta Scattering. Resonance Fluorescence and Interference Effects. Angular Dependencies of the Scattered γ -Radiation. Mössbauer γ -Quanta Scattering as a Method of Surface Study. Scattering Experiments with Detection of Characteristic X-rays. A Theory of Backscattering Mössbauer Spectroscopy (X-Rays Detection). Backscattering Mössbauer Spectroscopy by the Detection of X- and γ -Radiation. Practical Aspects. References. 3. **Mössbauer Spectroscopy Based on the Detection of Electrons.** The Interaction of Electrons with Matter Following Mössbauer Scattering. Conversion Electron Mössbauer Spectroscopy Theory Based on the Exponential Attenuation of the Electron Beam. Theory of CEMS Based on Elementary Electron Interactions. Depth Selective Conversion Electron Mössbauer Spectroscopy. β -Spectra and Weight Functions for DCEMS. Structure Determination of Near Surface

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Inorganic Polymeric Glasses

By **R.C. Ropp**, Warren, NJ, USA

Studies in Inorganic Chemistry Volume 15

The author describes a novel method of preparing hydrolysis-stable non-silicate glasses which is based on experimental work accomplished over the past twenty years. As such, the method is the beginning of a new approach to glass-making by the use of a molecularly-polymerizable precursor.

The book elucidates the technical details required to produce such molecularly-polymerized glasses from carefully prepared inorganic molecular monomers. Essentially, only silicate-based glasses have been known to be stable, whereas non-silicate glasses could not be attributed with such properties. Such glasses have, therefore, not found widespread usage in industry. The new phosphate glasses described here exhibit stabilities superior to many of the silicate glasses.

Researchers in glass and glass properties will find this volume extremely useful and those involved in organic polymers will be intrigued by the similarities and disparities of the two systems.

Contents: 1. Introduction to Silicate Glass Technology. Glass and Antiquity. The Glassy or Vitreous State. Glass Formers and Glass Compositions. The Manufacture of Silicate-Based Glasses. Forming and Finishing Operations. Thermal Processing and Properties of Silicate Glasses. Inherent Properties of Glass. Silicate Glass Products Currently being Manufactured. 2. Introduction to Polymeric Glasses. Prior Attempts to Prepare Stable Phosphate Glasses. Structural

Units in Glass. Basis for Chain Structure of Polymerized Phosphates. Prior Attempts to Prepare Phosphate Glasses by the Melting of Stoichiometric Compounds. Crystalline Salt Monomers for Stable Phosphate Glass Preparation.

3. Factors Contributing to the Preparation of Stable Phosphate Glasses.

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4. Further Aspects of Polymerized Phosphate Glasses. The Impurity Phase-Segregation Phenomenon. Phase Separation as

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5. Uses of Polymeric Phosphate Glasses.

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Dynamics of Excited Molecules

Edited by Kozo Kuchitsu

Studies in Physical and Theoretical Chemistry Volume 82

The physical and chemical properties of the molecular species reviewed in this book, and sometimes the species themselves, had been postulated or predicted but their exact details remained essentially unexplored for decades. The recent advances in chemical physics (such as laser spectroscopy and quantum-theoretical calculations) have provided techniques for their unambiguous identification.

Accurate data on their structures and dynamics are now available. Such information is indispensable for detailed discussion on the various properties of molecules and the mechanisms of intermolecular interactions and chemical interactions.

Information on the dynamics of excited molecules constitutes a firm basis of modern chemistry and physics. Moreover, it is of paramount importance in various fields of basic and applied sciences where chemical reactions play important roles: atomic and molecular physics, atmospheric and environmental science, space science, materials science, and biology.

This book contains 13 review articles on

- (1) the techniques for production and identification of excited molecules in the gas phase, condensed phases, and intermediate phases (intermolecular complexes and atomic or molecular microclusters)
- (2) their structures and dynamics (internal reactions) observed

mainly by spectroscopic experiments

- (3) their important roles in chemical processes. The target chemical species range from diatomics to relatively complicated aromatics in a variety of electronic and vibrational excited states, many of them being nonrigid or short-lived molecules, radicals, and positive or negative ions.

Contents:

1. Dynamics of excited molecules. An introduction (K. Kuchitsu, S. Tsuchiya).
2. Infrared diode laser and microwave kinetic spectroscopy (H. Kanamori *et al.*).
3. Free jet infrared spectroscopy of weakly bound complexes (M. Takami *et al.*).
4. Large-amplitude motions of aromatic molecules as studied by supersonic jet spectroscopy (M. Ito).
5. Decay processes of inner-shell photoexcited molecules (Y. Sato).
6. Dynamics of superexcited molecules (Y. Hatano).
7. Vibrational dynamics in highly excited polyatomic molecules (K. Yamanouchi, S. Tsuchiya).
8. Dynamics of ion-molecule reactions (I. Koyano).
9. Multiphoton ionization spectroscopy (H. Sato).
10. Excited-state electron donor-acceptor interaction of jet-cooled organic molecules (M. Itoh, O. Kajimoto).
11. Gas-phase cluster ions: stability, structure and solvation (K. Hiraoka, S. Yamabe).
12. Chemistry of gas-phase microclusters (K. Kaya, T. Kondow).
13. Transient ESR spectroscopy of short-lived triplet states and radicals (N. Hirota, S. Yamauchi).
14. Spectroscopic studies of radical ions in polyatomic matrices (T. Shida *et al.*).

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Physico-Chemical Properties of Selected Anionic, Cationic and Nonionic Surfactants

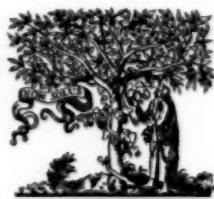
by N.M. van Os, J.R. Haak and L.A.M. Rupert

The number of physico-chemical investigations of surfactants in solution, whether aqueous or nonaqueous, has dramatically increased in recent years. However, literature reports on surfactants in solutions are scattered over a plethora of scientific journals and books which differ widely in scope and readership. Such data are often difficult to retrieve because there have been no systematic compilations, with the exception of those for CMCs and for micelle aggregation numbers.

The present compilation meets that need by covering, as completely as possible, the physico-chemical properties of selected series of homologous surfactants. These surfactants are in most cases isomerically pure, are well-known, and have been used in numerous academic and industrial studies. The properties include aggregation number, cloud point, CMC, ^{13}C -NMR, correlation length, counterion binding, density, enthalpy of micelle formation, entropy of micelle formation, Gibbs' free energy of micelle formation, head group area, ^1H -NMR, hydration number, Krafft temperature, melting point, micelle radius, microscopic viscosity, miscibility curve, partial molar volume,

phase inversion temperature, refractive index, self-diffusion coefficient, surface tension, and upper critical temperature. The book also contains two- and three-component phase diagrams of many nonionic surfactants.

The solvent is water in most cases; however, some data refer to properties in D_2O , electrolyte solutions, and nonaqueous solvents. The variables are temperature and concentration. Where possible, the method of measurement is given. Data on the purity of the compounds and the accuracy of the measurement methods are not included, as these can easily be found in the original sources, which mostly date from the period 1970-1991 and are given at the end of each chapter. The Index section contains a compound index, a property index, a symbol index and a cross index which facilitate easy access to the data.



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Part II: Cationic Surfactants. Alkyltrimethylammonium Salts. Alkylpyridinium Salts.
Part III: Nonionic Surfactants. Alkylpolyoxyethylene Glycol Ethers. Alkylphenol(ethylene oxide) Ethers.
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0009-2614(199404)211/220*:1-2

